

## TECHNICAL MEMORANDUM

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Date: April 30, 2015

To: San Francisco Bay Regional Water Quality Control Board

From: Paul Bedore, M.S.; Ben Giudice, Ph.D., P.E.

Cc: Greg Knapp, Nicole Granquist

On Behalf of: Lehigh Southwest Cement Company

Project: Permanente Quarry and Cement Plant Selenium Impact Assessment Study

Subject: Quarter 1, 2015 Report

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### Introduction

This memo summarizes results from samples collected in Quarter 1, 2015, pursuant to the Permanente Quarry Cement Plant Selenium Impact Assessment Study (Study). The Study Work Plan was initially submitted on May 17, 2013, and was a requirement of the 13267 Investigative Order, No. R2-2013-1005, issued in January 2013 by the San Francisco Bay Regional Water Quality Control Board (Regional Water Board) and finalized in a June 27, 2013 amended 13267 Investigative Order, No. R2-2013-1005-A1 (Order). The final Study Plan was submitted on July 11, 2013. Requests for modification of the Study Work Plan were included in the Year 1 Study Report, and the requested modifications were refined in consultation with the Regional Water Board. The final modifications to the Study Work Plan were approved by the Regional Water Board on July 10, 2014 (T.Yin, Regional Water Board, pers. comm., 7-10-14), and consisted of the removal of various constituents, the addition of background monitoring stations on Permanente and Stevens Creeks, and a change in schedule to move the June 2014 sampling event to July 2014. This report satisfies one of the quarterly reporting requirements in section 10b of the Order. An electronic data file containing all of the data collected to date is included as an attachment.

### Summary of Sampling Events in this Quarter (Q1 2015)

Permanente and Stevens Creeks were sampled on January 19, February 9, and March 26, 2015. The following sections summarize the sampling events.

#### ***January 19, 2015***

- The weather was clear, sunny, dry, and mild. The event commenced at 9:08 a.m. upon arrival at Wild Violet Creek and was complete by 2:50 p.m. Climactic conditions of the region up to this date were dry, with the most recent precipitation event having occurred

December 16–17, 2014 (approximately 1.15 inches total accumulation, as measured by the Santa Clara Valley Water District Maryknoll Fields gauge #1454).

- The Wild Violet Creek station (WVC) was dry, but moderate flow was observed in Permanente Creek at the background station PER US, just downstream of the confluence with WVC. There was low surface flow into Pond 13 (0.55 CFS), but very low, non-measurable surface flow into Pond 14. Downstream of Lehigh's property in Rancho San Antonio Open Space (Open Space), Permanente Creek was flowing at PER070 and PER060 (1.45 CFS), and West Permanente Creek was flowing at PER080 (0.55 CFS). However, Permanente Creek was not flowing at PER045. Thus, Permanente Creek and the Permanente Facility discharge were hydrologically disconnected from all sites downstream of the Open Space. Per the Work Plan, since sediment samples were not being collected during this event, no sites downstream of Pond 14 were sampled, except PER010.
- Water samples were collected at PER US, Pond 13, Pond 14, PER070, PER060, PER080, and PER010. Per the Work Plan, no sediment samples were collected this event.
- Flow was measured at Pond 13, PER080, and PER060.

### ***February 9, 2015***

- As specified in the Work Plan, the February sampling event targeted a period following a precipitation event that would result in capturing samples characteristic of runoff from within the watershed. Sampling was conducted on February 9, 2015 following a three-day period of substantial precipitation. Over the period of February 6–8, 2015, the area received 3.96 inches of rain (total accumulation for the 72 hour period, as measured by the Santa Clara Valley Water District Maryknoll Fields gauge #1454).
- On February 9, 2015, the weather was dry (no precipitation was received during the period of sampling), mild, and sunny with scattered clouds. The event commenced at 9:40 a.m. upon arrival at Wild Violet Creek and was complete by 4:10 p.m.
- Wild Violet Creek had a minimal amount of surface flow present at the upstream end of the sampling site, but this flow went subsurface at the WVC sampling station. Thus, Wild Violet Creek was connected only by subsurface flow to Permanente Creek. Moderate flow was present at PER US. Water levels in Pond 13 and Pond 14 were elevated due to moderate inflow (3.64 CFS into Pond 13 and 2.31 CFS into Pond 14). Flow was present in the section of Permanente Creek located in the Open Space at stations PER070 and PER060 (7.09 CFS), and flow was present at the West Permanente Creek station, PER080 (4.31 CFS). Flow in Permanente Creek continued downstream of the Open Space to station PER045 (12.62 CFS), but all of this flow continued on in the diversion channel to Stevens Creek. As a result, PER035 on Permanente Creek downstream of the diversion channel was dry. Flow was present further downstream on Permanente Creek at PER010. On Stevens Creek, flow was present immediately downstream of the diversion channel at station STE040 (10.97 CFS). Water at STE040 consisted entirely of flow from the Permanente Creek diversion channel because Stevens Creek was dry upstream of diversion channel outfall. Low flow was also present in Stevens Creek at STE020 and STE010. Tides influence flow direction and water quality at STE010, and at the time of sampling, low, slack tide conditions were occurring.

- Based on the flow observations and measurements described above, the Lehigh discharge was hydraulically connected to Permanente Creek upstream of the diversion channel, to Stevens Creek downstream of diversion channel outfall, and to lower South Bay. The Lehigh discharge was not hydraulically connected to Permanente Creek downstream of the diversion channel.
- Water samples were collected at PER US, Pond 13, Pond 14, PER080, PER070, PER060, PER045, PER010, STE040, STE020, and STE010. Per the Work Plan, no sediment samples were collected this event.
- Flow was measured at Pond 13, Pond 14, PER080, PER060, PER045, and STE040.

### ***March 26, 2015***

- The weather was clear, sunny, dry, and warm. The event commenced at 9:45 a.m. upon arrival at Wild Violet Creek and was complete by 4:47 p.m. Climactic conditions in the region up to this date were dry, with the most recent precipitation event having occurred February 6–8, 2015, just prior to the February 2015 sampling event.
- Wild Violet Creek was dry, while flow was present at the background sampling station on Permanente Creek, PER US. Water levels in Pond 13 and Pond 14 were high due to elevated inflow to the ponds (4.21 CFS into Pond 13 and 1.42 CFS into Pond 14). Flow was present in the section of Permanente Creek located in the Open Space at stations PER070 and PER060 (4.06 CFS), and low flow was present at the West Permanente Creek station, PER080 (0.49 CFS). Flow in Permanente Creek continued downstream of the Open Space to station PER045 (2.63 CFS), but all of this flow continued on in the diversion channel to Stevens Creek. As a result, PER035 on Permanente Creek downstream of the diversion channel was dry. Flow was present further downstream on Permanente Creek at PER010. On Stevens Creek, flow was present immediately downstream of the diversion channel at station STE040 (2.12 CFS), and water at this location consisted entirely of flow from the Permanente Creek diversion channel because Stevens Creek was dry upstream of diversion channel outfall. Flow was also present in Stevens Creek at STE020 and STE010. A low, out-going tide was occurring while station STE010 was sampled.
- Based on the flow observations and measurements described above, the Lehigh discharge was hydraulically connected to Permanente Creek upstream of the diversion channel and to Stevens Creek immediately downstream of the diversion channel outfall. Because there is approximately four miles between STE040 and STE020, it is likely that the relatively low flow (2.12 CFS) observed in Stevens Creek at STE040 did not persist in the four mile stretch downstream to the next sampling station, STE020. That is, flow occurring at STE040 went subsurface upstream of STE020. This is supported by the measurements of selenium which was ten times greater at STE040 than at STE020 (a similar trend also occurs for sulfate measurements). Therefore, it is unlikely that the Lehigh discharge was hydraulically connected to lower Stevens Creek at stations STE020 and STE010, though due to lack of access to the creek in this reach, this is uncertain. The Lehigh discharge was not hydraulically connected to Permanente Creek downstream of the diversion channel.

- Water samples were collected at PER US, Pond 13, Pond 14, PER080, PER070, PER060, PER045, PER010, STE040, STE020, and STE010.
- Sediment was collected at PER US, Pond 13, PER060, PER045, PER035, STE020, STE010, and PER010.
- Flow was measured at Pond 13, Pond 14, PER080, PER060, PER045, and STE040.

## Issues Encountered in Sampling/Analysis

No issues were encountered in sampling and analysis.

At the time of report preparation, the lab report for the grain size analysis of sediment samples collected on March 26, 2015 was not yet available. These results will be provided in the Year 2 Annual Report (due June 30, 2015).

## Deviations from Work Plan

No deviations from the revised Work Plan were encountered during the Q1 2015 sampling events.

## Data

Measurements taken in the field, including flow, pH, temperature, etc., are reported in Appendix B. Selenium concentrations measured in water and sediment samples are provided in Appendix C. Other constituents that were measured in water and sediment samples are reported in Appendix D. Except where noted above, all of the data from the sampling events has been provided in an electronic file accompanying this memo.

### *Water*

The following are general observations regarding levels of conventional constituents in the January, February, and March water samples.

- Hardness (as  $\text{CaCO}_3$ ) at the background stations PER US and PER080 ranged 236–388 mg/L across all dates. In January, hardness at stations connected to Lehigh's discharge ranged 714–761 mg/L. In February, hardness ranged 414–574 mg/L at stations on and downstream of the Lehigh property. In March, hardness decreased from approximately 700 mg/L in Pond 13, Pond 14, PER070, and PER060 to 600 mg/L at STE040, and further to 490 mg/L at STE020 and STE010.
- The sulfate concentration (as  $\text{SO}_4^{2-}$ ) at the background site PER US and PER080 ranged 10–47 mg/L across all dates. Sulfate at PER010 ranged from 140–210 mg/L across all dates. In January, sulfate ranged 460–540 mg/L at stations connected to Lehigh's discharge. In February, sulfate ranged 120–360 mg/L at stations on and downstream of the Lehigh property, with concentrations decreasing toward the Bay. In March, sulfate ranged 460–590 mg/L at stations on and downstream of the Lehigh property to Stevens Creek at STE040, while further downstream sulfate was 130 mg/L at STE020 and STE010.

- At all stations, TOC concentrations ranged 1.3–4.29 mg/L in January and 1.05–4.74 mg/L in March. In February, TOC levels were relatively higher, ranging 2.81–14.5 mg/L, and increased in concentration downstream of Lehigh’s property.
- In January and March, TSS concentrations ranged from <1 to 6 mg/L at all stations, with the exception of PER010 in January (17 mg/L). TSS levels were elevated at all stations in February (7–27 mg/L), with the exception of PER US (1.5 mg/L).

The following are general observations regarding levels of selenium (Se) in the January, February, and March water samples.

- Overall, concentrations of selenium occurring on Lehigh property (Pond 13 and Pond 14) were highest in March, followed by January and February. Levels of selenium were similar at Pond 13, Pond 14, PER070, and PER060. Selenium levels decreased downstream of the Open Space in February and March, with the greatest rate of decrease occurring in February, likely due to additional water inputs to Permanente and Stevens Creek from runoff and emergent groundwater flow. Dissolved and total Se levels were essentially equivalent during the sampling events, and Se(VI) (selenate) was the dominant species. Levels of total selenium at the background stations PER US and PER080, which are not hydraulically connected to Lehigh’s discharge, were less than 1 µg/L. At PER010, which was also disconnected from the Lehigh discharge during the January, February and March sampling events, total selenium was less than 2 µg/L.
- In January, total selenium levels at stations affected by the quarry discharge on Lehigh property (Pond 13 and Pond 14) and in the Open Space (PER070 and PER060) ranged 16–23 µg/L.
- In February, total selenium levels ranged 9.34–14.1 µg/L at Pond 13, Pond 14, PER070, and PER060; 7.83–7.97 µg/L at PER045 and STE040; and 3.78–4.56 µg/L at STE020 and STE010.
- In March, total selenium levels ranged 28.1–33.7 µg/L at Pond 13, Pond 14, PER070, and PER060; 19.2–20.5 µg/L at PER045 and STE040; and 2.85–2.87 µg/L at STE020 and STE010. Relative to concentrations upstream, the total selenium concentrations at STE020 and STE010 are substantially lower, suggesting that these stations were not hydraulically connected to Lehigh’s discharge.

### *Sediment*

The following are general observations regarding levels of conventional constituents and selenium (on a dry weight basis) in the March 26, 2015 sediment samples.

- Sulfate levels in sediment samples were highest at STE010 (1700 mg/L as  $\text{SO}_4^{2-}$ ), followed by Pond 13 (320 mg/L as  $\text{SO}_4^{2-}$ ); PER060, PER045, and PER010 (90–120 mg/L as  $\text{SO}_4^{2-}$ ); and PER US, PER035, and STE020 (17–43 mg/L as  $\text{SO}_4^{2-}$ ).
- TOC levels in sediment samples were highest at PER035 (42,000 mg/L), followed by PER US, Pond 13, PER045, and STE010 (14,000–19,000 mg/L), followed by PER060, PER010, and STE020 (4,600–9,500 mg/L).
- Levels of Se in Pond 13 (5.01 mg/kg) were substantially higher than at all other stations. At all other stations, levels of Se in sediment were low ( $\leq 0.906$  mg/kg).

## Quality Assurance/Quality Control

The following summarizes quality assurance/quality control issues.

### *Water*

- A field duplicate water sample was collected from Pond 14 on March 26, 2015. The residual percent difference (RPD) in total Se and dissolved Se measured in the water field duplicate sample (FD Pond 14) were 3% and 8% respectively, both below the measurement quality objective (MQO) of 25%.
- In the testing of samples collected on January 19, February 9 and March 26, 2015, recoveries of calcium in one matrix spike from every batch and one matrix-spike duplicate from the March 26, 2015 batch were outside of acceptable limits. This is due to the spike level (8 mg/L) being much lower than the native concentration of matrix spike samples (50–200 mg/L). Because the sample duplicates, additional matrix spikes and the lab control spikes yielded acceptable recoveries, and magnesium and calcium are not a parameter of primary importance to the study, no action was taken.
- With regards to selenium species, all recoveries and RPDs for laboratory QC samples (matrix spike, matrix spike duplicates, laboratory spike, laboratory spike duplicates) were within acceptable limits. One exception was the internal calibration verification (ICV) standards for the measurement of dissolved selenium samples from March 26, 2015. The continuing calibration verification standards and continuing calibration blanks (CCB) ICVs from this analytical run were above the control limit of 125% (at 133% and 130%, respectively, for the CCV and CCB). Although their internal standard recoveries were elevated, the recovery of Se in the CCV tested at the opening of the analytical run was within acceptance limits (102.1%) and the concentration of Se detected in the opening CCB (0.005µg/L) was significantly less than the reporting limit (0.040µg/L). The internal standard recoveries of all other samples associated with this batch were within acceptance limits (ranging from 93% to 120%), as were all other quality control parameters for Se. Since all quality control data indicate that the internal standards properly corrected for any instrument drift, no corrective action was taken. Based on this information, the laboratory determined that the reported dissolved Se results wererepresentative of the submitted samples from March 26, 2015.

### *Sediment*

- A field duplicate sediment sample was collected at Pond 13 on March 26, 2015. The RPD in total Se measured on a dry-weight basis in the sediment field duplicate sample (FD Pond 13) was 26%, which is outside the MQO of 25%. In this case, the elevated RPD is not a concern because it is a result of the compounding of the differences in total selenium measured on a wet-weight basis (12% RPD), and the difference in percent moisture between the two samples (10% RPD) which is used to convert total Se measurements based on wet-weight to dry weight. The RPD of total Se on a wet weight basis and percent moisture were below the MQO of 25%.

- With regards to selenium analysis, all recoveries and RPDs for laboratory QC samples (laboratory control spike, matrix spike, matrix spike duplicates, reference material) were within acceptable limits.
- The matrix spike and matrix spike duplicate QC samples for sediment TOC yielded recoveries of 72% and 73%, which were slightly outside the laboratory's lower recovery control limit of 75%. Sediment TOC results were determined to be acceptable on the basis that the laboratory control spike samples yielded acceptable recoveries.

## Appendix A



Photo Log



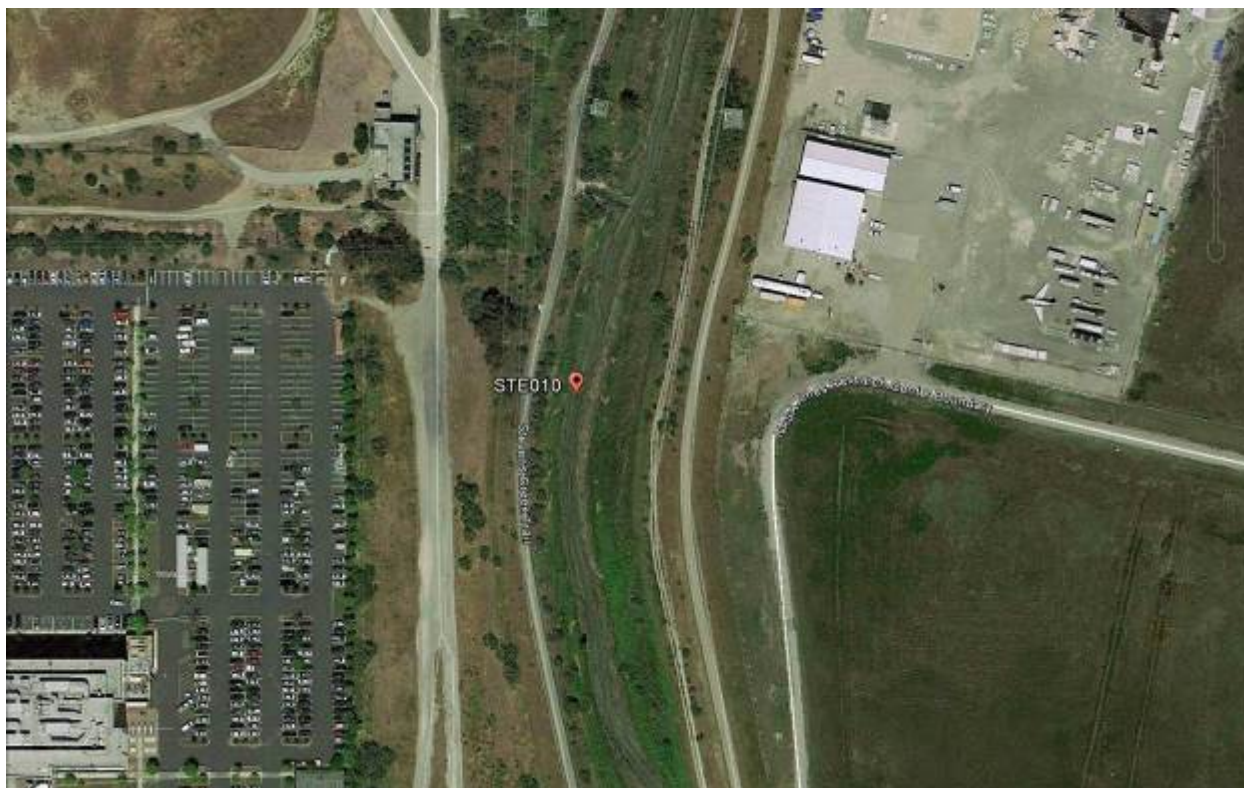


Figure A 1. STE010 sampling station on Stevens Creek (March 26, 2015).



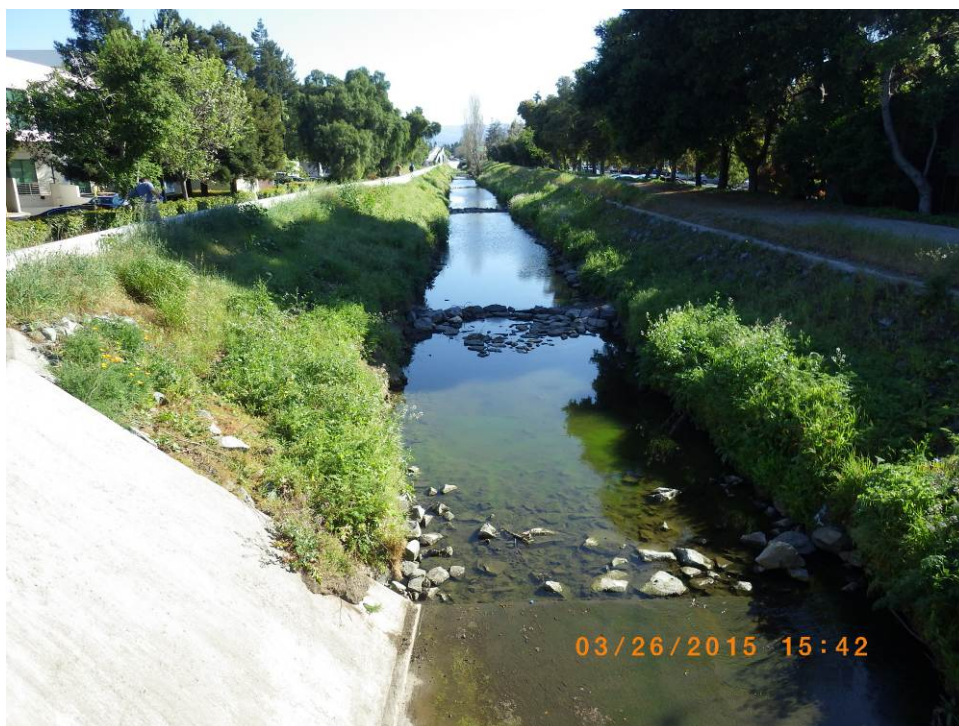


Figure A 2. PER010 sampling station on Permanente Creek (March 26, 2015).





Figure A 3. PER035 sampling station on Permanente Creek (March 26, 2015).



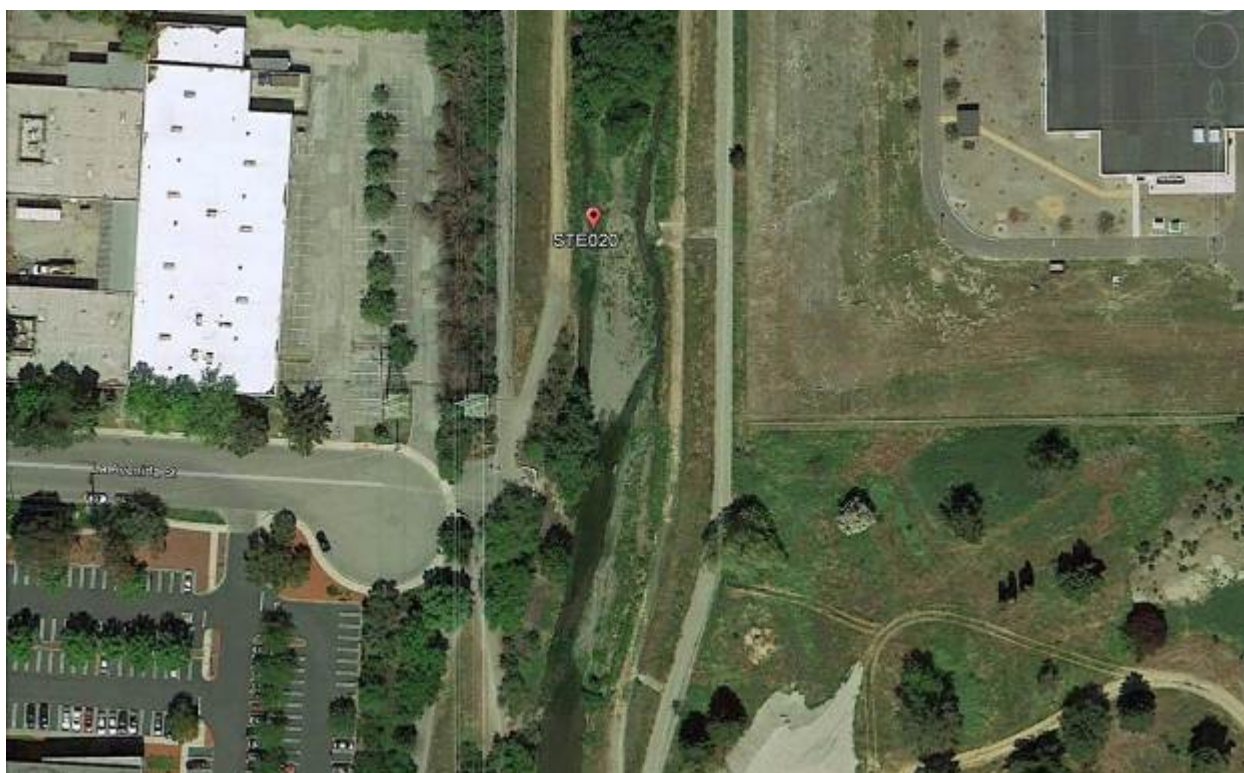


Figure A 4. STE020 sampling station on Stevens Creek (March 26, 2015).



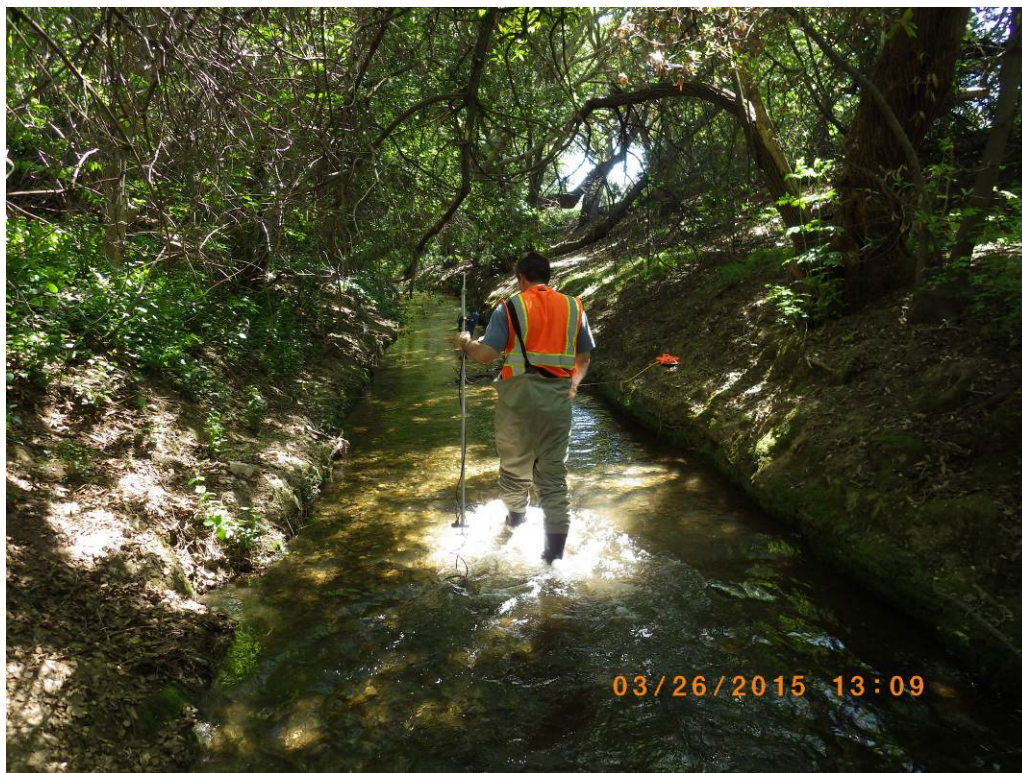


Figure A 5. PER045 sampling station on Permanente Creek (March 26, 2015).





Figure A 6. PER060 sampling station on Permanente Creek (March 26, 2015).





Figure A 7. PER070 sampling station on Permanente Creek (March 26, 2015).



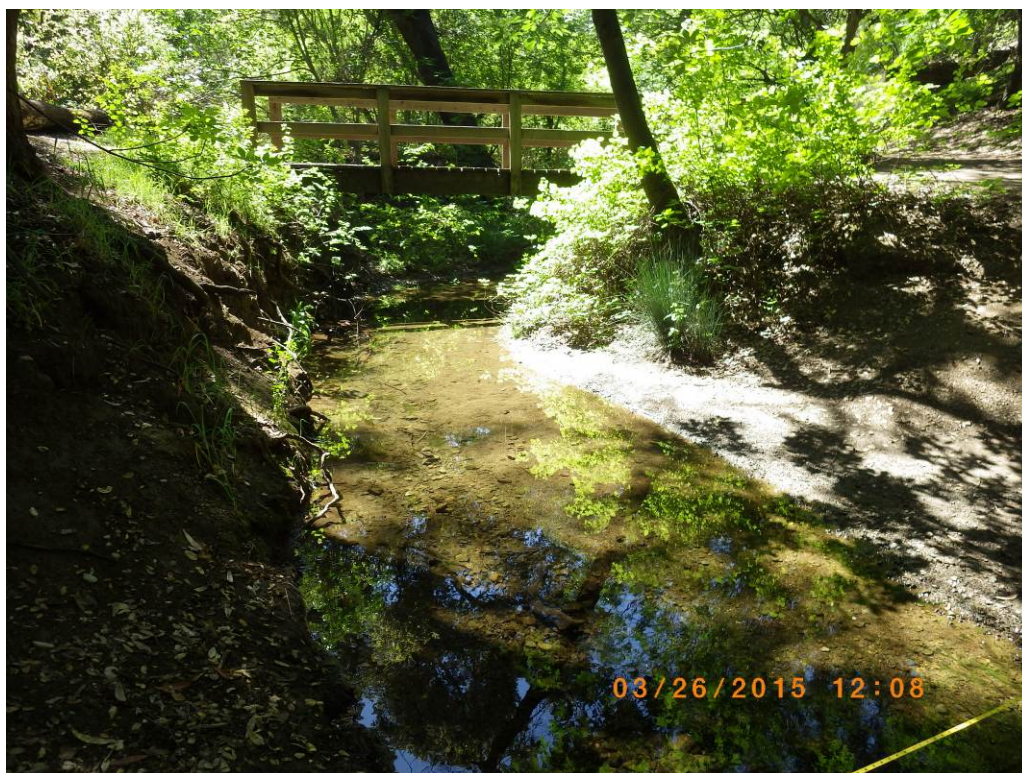


Figure A 8. PER080 sampling station on Permanente Creek (March 26, 2015).





Figure A 9. Pond 14 sampling station (March 26, 2015).



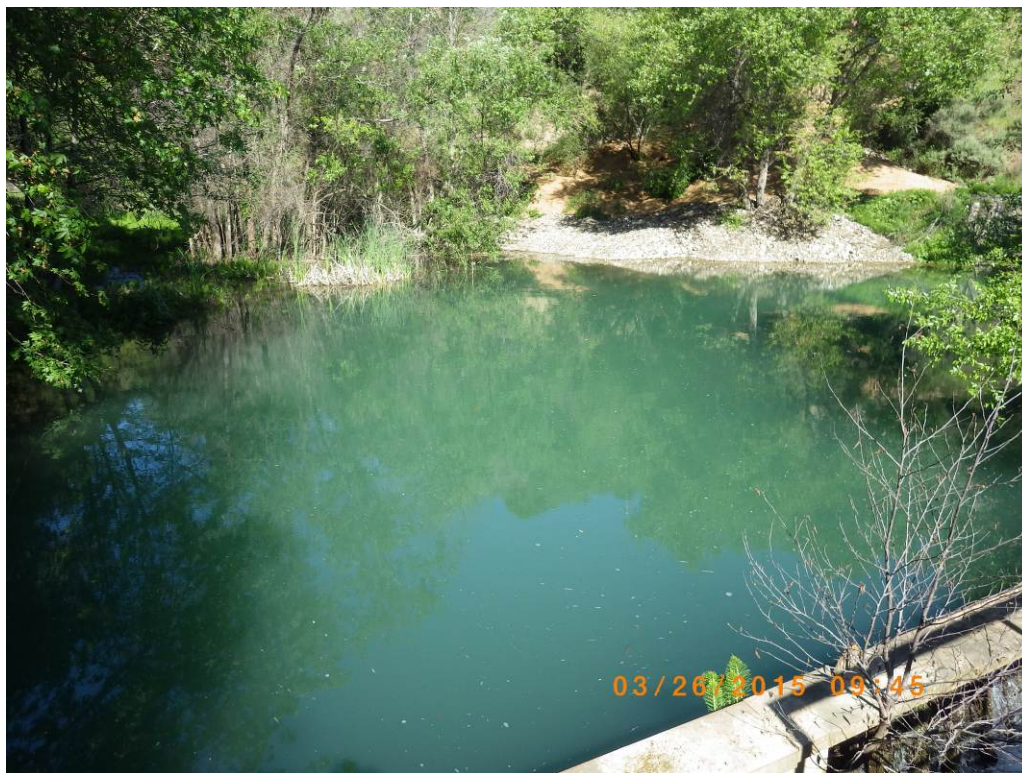


Figure A 10. Pond 13 sampling station (March 26, 2015).





Figure A 11. PER US sampling station on Permanente Creek (March 26, 2015).





Figure A 12. WVC sampling station on Wild Violet Creek (March 26, 2015).

Appendix B



Field Data

Table 1. Field Measurements and Data Collected on January 19, 2015.

Sample ID	Date Collected	Begin Time	End Time	Flow Condition	Water Collected	Sediment Collected	Continuous Water Column	Flow Measured	Flow (cfs)	pH	Temp (°C)	EC (μS/cm)	DO (mg/L)	DO (%)	ORP (mV)	Notes
WVC	1/19/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Visited. No flow and dry.
PER US	1/19/2015	9:08	9:12	Flow	Yes	--	--	--	--	8.3	11.9	596	10.07	93.2	110	Clear, flowing steady. < 1 cfs - higher than seen since summer 2014.
Pond 13	1/19/2015	11:00	11:02	Flow	Yes	--	--	Yes	0.55	8.7	14.7	138	9.66	95.6	154	Flow into and out of pond over spillway. Abundant floating, brown algae. Rock slide into NW corner of pond is visibly greater than previous visits. Slope of slide to top of ridge is covered with straw or burlap to stabilize slope from erosion.
Pond 14	1/19/2015	12:00	12:10	Flow	Yes	--	--	See Notes	--	8.4	14.5	1435	8.59	87.2	171	Pond full, relatively clear. Extremely low inflow (trickle), unmeasurable.
PER 080	1/19/2015	13:20	13:25	Flow	Yes	--	--	Yes	0.57	8.2	14.3	795	8.68	86.8	175	Flow.
PER 070	1/19/2015	12:55	13:00	Flow	Yes	--	--	--	--	8.6	15.4	1455	10.18	101.8	182	Flow, clear water.
PER 060	1/19/2015	13:40	13:42	Flow	Yes	--	--	Yes	1.45	8.1	14.5	1408	8.95	90.8	180	Flow.
PER 045	1/19/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	No flow and dry.
PER 035	1/19/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Site not visited.
HAL 010	1/19/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Site not visited.
PER 010	1/19/2015	14:35	14:50	Flow	Yes	--	--	--	--	8.2	16.4	1458	13.24	136.2	165	Moderate flow, high turbidity with some floating debris/algae.
STE 040	1/19/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Site not visited.
STE 020	1/19/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Site not visited.
STE 010	1/19/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Site not visited.

-- No data to report.

Table 2. Field Measurements and Data Collected on February 9, 2015.

Sample ID	Date Collected	Begin Time	End Time	Flow Condition	Water Collected	Sediment Collected	Continuous Water Column	Flow Measured	Flow (cfs)	pH	Temp (°C)	EC (μS/cm)	DO (mg/L)	DO (%)	ORP (mV)	Notes
WVC	2/9/2015	9:40	--	See Notes	No	--	--	--	--	--	--	--	--	--	--	Minimal flow from Wild Violet Creek to site WVC, where the water went sub-surface. Creek was dry for ~40 feet to the confluence with Permanente Creek.
PER US	2/9/2015	9:44	10:00	Flow	Yes	--	--	--	--	8.8	12.1	492	9.9	93	118	Water clear, flow estimated by sight to be 2-3 CFS. Flow upstream on Permanente Creek on WVC, but WVC went subsurface, with no surface flow connectivity between Permanente Creek and Wild Violet Creek. Most of WVC was dry, no sample of WVC.
Pond 13	2/9/2015	10:55	11:02	Flow	Yes	--	--	Yes	3.64	8.8	15.5	979	8.98	91.4	119	Surface flow into pond from Permanente Creek. Turbid, greenish brown water.
Pond 14	2/9/2015	12:05	12:07	Flow	Yes	--	--	Yes	2.31	8.6	16.6	1109	9.27	96.3	122	Pond level up. Brown, turbid water. Inflow through conduits. Some flow into pond from runoff over banks/through banks.
PER 080	2/9/2015	13:05	13:06	Flow	Yes	--	--	Yes	4.31	8.4	14.7	661	9.03	90.6	130	Elevated flow. Water is slightly turbid.
PER 070	2/9/2015	12:35	12:50	Flow	Yes	--	--	--	--	8.7	15.6	945	9.11	94.9	123	Turbid, well flowing water.
PER 060	2/9/2015	13:35	13:38	Flow	Yes	--	--	Yes	7.09	8.5	15.4	1145	9.34	95.2	138	High flow. Turbid water.
PER 045	2/9/2015	14:05	14:08	Flow	Yes	--	--	Yes	12.62	8.9	15.5	972	9.83	99.8	136	High flow. Turbid water.
PER 035	2/9/2015	14:15	14:15	No Flow	No	--	--	--	--	--	--	--	--	--	--	Site dry. No flow or water.
HAL 010	2/9/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Site not visited.
PER 010	2/9/2015	16:08	16:10	Flow	Yes	--	--	--	--	8.8	15.5	1032	9.51	96.8	132	Water slightly turbid; moderate flow. Murky, slight green/brown tint to water.
STE 040	2/9/2015	14:50	14:53	Flow	Yes	--	--	Yes	10.97	8.9	15.8	934	9.64	99.8	123	High flow out of diversion channel into Stevens Creek. Turbid, cloudy water. No flow from Stevens Cr. Upstream of diversion channel. Flow from diversion channel has eddied and flowed into pool in Stevens Cr. Just upstream of the outfall. All upstream water is from diversion channel.
STE 020	2/9/2015	15:15	15:30	Flow	Yes	--	--	--	--	8.5	17.3	802	8.9	94.1	136	Slightly turbid water. Channel was braided at sampling site. Plants pushed down and scoured by recent high flow.
STE 010	2/9/2015	15:40	15:55	Flow	Yes	--	--	--	--	8.3	17.5	816	8.09	85.6	142	Turbid water. Low, slack tide.

-- No data to report.

Table 3. Field Measurements and Data Collected on March 26, 2015.

Sample ID	Date Collected	Begin Time	End Time	Flow Condition	Water Collected	Sediment Collected	Continuous Water Column	Flow Measured	Flow (cfs)	pH	Temp (°C)	EC (μS/cm)	DO (mg/L)	DO (%)	ORP (mV)	Notes
WVC	3/26/2015	9:45	9:45	No Flow	No	No	--	--	--	--	--	--	--	--	--	Site dry. No flow or water.
PER US	3/26/2015	9:45	9:55	Flow	Yes	Yes	--	--	--	8.3	12.6	591	9.99	93.4	85	Clear flowing water.
Pond 13	3/26/2015	10:55	11:35	Flow	Yes	Yes	--	Yes	4.21	8.7	18.8	1361	9.51	103.6	118	Water level high. Elevated in/out flow. Water slightly turbid, turquoise in color. Algae smell, but no visible algae or plants in pond. Fiedl duplicate sediment sample collected.
Pond 14	3/26/2015	11:50	12:05	Flow	Yes	--	--	Yes	1.42	8.4	19.6	1380	9.4	102.6	123	Pond level high, flow in/out of pond. Water fairly clear, algae smell, some small patches of floating algae. Field duplicate water sample collected.
PER 080	3/26/2015	12:50	12:55	Flow	Yes	--	--	Yes	0.49	8	16.2	752	8.38	89.4	141	Clear, flowing water.
PER 070	3/26/2015	12:25	12:40	Flow	Yes	--	--	--	--	8.7	19.6	1372	9.41	101.6	133	Clear, flowing water.
PER 060	3/26/2015	13:20	13:40	Flow	Yes	Yes	--	Yes	4.06	8.2	17.9	1377	9.04	99.8	145	Relatively high flow. Clear water.
PER 045	3/26/2015	14:05	14:22	Flow	Yes	Yes	--	Yes	2.63	8.8	19.1	1288	9.79	105.1	137	Clear flowing water. Not much fine grain material in channel. Rocky, gravelly sediments.
PER 035	3/26/2015	14:38	14:42	No Flow	No	Yes	--	--	--	--	--	--	--	--	--	Site dry. No flow or water.
HAL 010	3/26/2015	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Site not visited.
PER 010	3/26/2015	16:30	16:47	Flow	Yes	Yes	--	--	--	8.3	15.7	1263	12.2	148.1	144	Relatively clear, flowing water. Some floating solids.
STE 040	3/26/2015	15:00	15:05	Flow	Yes	--	--	Yes	2.12	8.9	24	1222	10.65	127.4	128	Clear flowing water. STE040 US - dry and no flow. All water at STE040 is from the diversion channel.
STE 020	3/26/2015	15:35	15:40	Flow	Yes	Yes	--	--	--	8.4	24.4	983	10.12	119	137	Clear flowing water. Low level, braided channel.
STE 010	3/26/2015	16:15	16:35	Flow	Yes	Yes	--	--	--	8.4	25.8	1051	9.01	110.1	144	Low water level. Low tide, water flow toward downstream (bay). Turbid water.

-- No data to report.



## Appendix C



Selenium Data

Table 3. Selenium Results for Water Samples Taken on January 19, February 9, and March 26, 2015.

Sample ID	Date Collected	Units	Total Se	Diss. Se	Se(IV)	Se(VI)	SeCN	Additional Se Species (n)
PER US	1/19/2015	µg/L	0.593	0.50	< 0.032 U	0.472 J	< 0.046 U	0 (0)
Pond 13	1/19/2015	µg/L	15.9	17.9	1.37	16.1	< 0.046 U	0.113 (2)
Pond 14	1/19/2015	µg/L	22.6	23.6	1.59	22.2	< 0.046 U	0.246 (2)
PER 070	1/19/2015	µg/L	19.2	20.4	1.08	19.0	< 0.046 U	0 (0)
PER 080	1/19/2015	µg/L	0.891	1.15	0.140 J	0.945	< 0.046 U	0 (0)
PER 060	1/19/2015	µg/L	16.8	18.2	0.741	17.3	< 0.046 U	0 (0)
PER 010	1/19/2015	µg/L	0.954	1.28	0.128 J	0.857	< 0.046 U	0 (0)
PER US	2/9/2015	µg/L	0.46	0.420	0.010 J	0.309 J	< 0.017 U	0 (0)
Pond 13	2/9/2015	µg/L	9.34	9.75	0.667	8.08	< 0.017 U	0.098 (2)
Pond 14	2/9/2015	µg/L	14.1	14.5	0.785	12.3	< 0.017 U	0.095 (2)
PER070	2/9/2015	µg/L	12.2	12.9	0.654	10.8	< 0.017 U	0.065 (2)
PER080	2/9/2015	µg/L	0.55	0.541	0.022 J	0.342 J	< 0.017 U	0 (0)
PER060	2/9/2015	µg/L	13.2	13.5	0.675	11.4	< 0.017 U	0.067 (2)
PER045	2/9/2015	µg/L	7.83	8.57	0.423 J	6.77	< 0.017 U	0.056 (3)
STE040	2/9/2015	µg/L	7.97	8.65	0.445 J	6.80	< 0.017 U	0.066 (3)
STE020	2/9/2015	µg/L	4.56	4.62	0.279 J	3.84	< 0.017 U	0.064 (3)
STE010	2/9/2015	µg/L	3.78	3.50	0.245 J	2.94	< 0.017 U	0.047 (2)
PER010	2/9/2015	µg/L	1.94	1.69	0.235 J	1.14	< 0.017 U	0.066 (3)
PER US	3/26/2015	µg/L	0.368 J	0.357 J	< 0.017 U	0.429 J	< 0.017 U	0 (0)
Pond 13	3/26/2015	µg/L	33.7	31.6	3.20	31.1	< 0.017 U	0 (0)
Pond 14	3/26/2015	µg/L	29.3	30.5	2.37	28.0	< 0.017 U	0 (0)
FD Pond 14	3/26/2015	µg/L	28.4	28.0	2.50	27.8	< 0.017 U	0 (0)
PER070	3/26/2015	µg/L	28.1	27.0	2.20	27.2	< 0.017 U	0 (0)
PER080	3/26/2015	µg/L	0.440	0.435	< 0.017 U	0.248 J	< 0.017 U	0 (0)
PER060	3/26/2015	µg/L	25.1	25.0	1.81	24.3	< 0.017 U	0 (0)
PER045	3/26/2015	µg/L	20.5	21.7	1.44	20.3	< 0.017 U	0 (0)
STE040	3/26/2015	µg/L	19.2	20.2	1.49	18.9	< 0.017 U	0 (0)
STE020	3/26/2015	µg/L	2.87	3.09	0.355 J	2.84	< 0.017 U	0 (0)
STE010	3/26/2015	µg/L	2.85	2.74	0.425 J	2.23	< 0.017 U	0 (0)
PER010	3/26/2015	µg/L	0.708	0.671	0.133 J	0.445 J	< 0.017 U	0 (0)

U = Sample concentration is below the estimated method detection limit (eMDL)

J = Sample concentration is between the eMDL and the reporting limit (RL)

SeCN = Selenocyanate

Additional Se Species = Sum of all additional Se species observed by IC-ICP-MS

n = number of unknown Se species observed

FD = Field Duplicate

Table 4. Selenium Results for Sediment Samples Taken on March 26, 2015.

Sample ID	Date Collected	Units	Total Se (WW)	Total Se (DW)	Percent Solids (%)
PER US	3/26/2015	µg/g	0.135	0.215	62.8
Pond 13	3/26/2015	µg/g	3.00	5.01	59.8
FD Pond 13	3/26/2015	µg/g	3.41	6.30	54.1
PER060	3/26/2015	µg/g	0.458	0.622	73.6
PER045	3/26/2015	µg/g	0.319	0.425	75.1
PER035	3/26/2015	µg/g	0.755	0.906	83.3
STE020	3/26/2015	µg/g	0.247	0.312	79.2
STE010	3/26/2015	µg/g	0.203	0.540	37.7
PER010	3/26/2015	µg/g	0.344	0.441	78.0

U = Sample concentration is below the estimated method detection limit (eMDL)

J = Sample concentration is between the eMDL and the reporting limit (RL)

WW = Wet Weight (As Received) Basis

DW = Dry Weight Basis

FD = Field Duplicate

## Appendix D



### Monitoring Data for Other Constituents

Table D1. Monitoring Data for Other Constituents.

Station/ Date	Total Alkalinity as CaCO <sub>3</sub> (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Hardness, Total as CaCO <sub>3</sub> (mg/L)	Sulfate as SO <sub>4</sub> (mg/L)	Chlorophyll-a (mg/L)	Total Organic Carbon (mg/L)	Total Suspended Solids (mg/L)	Sediment Sulfate as SO <sub>4</sub> (mg/kg)	Sediment Total Organic Carbon (mg/kg)
<b>WVC</b>										
07/09/13									170	8600
09/04/13									18	16000
12/09/13									26	34000
03/20/14									13	26000
<b>PER US</b>										
04/01/14	280	51	36	275	14	0.0001	2.4	11.0		
07/17/14		90	28	337	20		0.9	5.7	23	25000
09/11/14									27	6700
12/10/14		82	31	332	18		1.9	ND	27	35000
01/19/15		72	29	301	16		1.3	ND		
02/09/15		51	26	236	10		3.3	1.5		
03/26/15		64	41	331	14		1.1	ND	20	16000
<b>Pond 13</b>										
07/09/13	140	150	41	541	380	ND	1.3	ND	290	27000
09/04/13	130	130	51	530	420	ND	5.9	ND	3400	39000
11/04/13	130	140	61	588	390	0.0059	5.5	0.8		
12/09/13	90	110	64	543	440	ND	4.4	1.2	2300	27000
01/15/14	95	110	60	531	450	0.0009	5.7	ND		
02/10/14	160	140	60	608	420	0.0060	3.8	21.0		
03/20/14	160	190	44	657	500	0.0001	1.0	7.4	360	17000
04/01/14	160	150	35	525	430	0.0003	1.1	9.5		
07/17/14		120	63	562	540		4.2	1.1	580	15000
09/11/14		120	73	602	530		5.7	2.1	820	19000
11/12/14		140	84	693	570		4.3	1.8		
12/10/14		200	51	710	460		3.9	9.7	450	9400
01/19/15		200	53	718	520		1.8	1.2		
02/09/15		130	39	476	310		2.8	9.2		

Station/ Date	Total Alkalinity as CaCO3 (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Hardness, Total as CaCO3 (mg/L)	Sulfate as SO4 (mg/L)	Chlorophyll-a (mg/L)	Total Organic Carbon (mg/L)	Total Suspended Solids (mg/L)	Sediment Sulfate as SO4 (mg/kg)	Sediment Total Organic Carbon (mg/kg)
03/26/15		200	48	708	590		1.3	1.7	320	19000
<b>Pond 14</b>										
07/09/13	160	140	48	548	410	ND	2.6	ND		
09/04/13	240	140	62	602	430	0.0290	6.3	1.7	4000	47000
11/04/13	220	170	52	645	350	0.0180	6.1	2.4		
12/09/13	180	170	42	589	430	0.0120	5.2	2.4		
01/15/14	240	160	47	589	410	0.0250	3.9	9.8		
02/10/14	160	140	33	476	370	0.0063	5.7	10.0		
03/20/14	180	170	46	604	460	0.0010	2.5	8.8		
04/01/14	160	160	42	574	440	0.0010	1.8	16.0		
07/17/14		160	57	643	490		5.7	5.1		
09/11/14		170	67	697	430		6.1	4.8	300	36000
11/12/14		160	72	696	410		5.7	2.0		
12/10/14		190	55	710	450		3.7	5.0		
01/19/15		200	59	755	540		2.0	ND		
02/09/15		130	39	484	350		4.4	14.0		
03/26/15		200	50	706	570		1.3	ND		
<b>PER080</b>										
07/09/13	320	70	45	360	46	ND	1.7	1.3		
09/04/13	340	69	48	371	41	ND	2.2	8.8		
01/19/15		74	50	388	47		4.0	1.2		
02/09/15		58	36	290	41		7.8	17.0		
03/26/15		67	42	338	42		2.8	ND		
<b>PER070</b>										
07/09/13	180	150	46	573	410	ND	1.3	ND		
02/10/14	170	140	34	496	390	0.0036	4.5	ND		
03/20/14	190	160	45	579	480	0.0010	2.4	1.8		
04/01/14	160	150	39	544	460	0.0006	1.9	2.6		
07/17/14		66	23	258	100		3.6	ND		
12/10/14		200	63	756	470		2.7	1.7		

Station/ Date	Total Alkalinity as CaCO3 (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Hardness, Total as CaCO3 (mg/L)	Sulfate as SO4 (mg/L)	Chlorophyll-a (mg/L)	Total Organic Carbon (mg/L)	Total Suspended Solids (mg/L)	Sediment Sulfate as SO4 (mg/kg)	Sediment Total Organic Carbon (mg/kg)
01/19/15		200	61	761	530		1.8	1.0		
02/09/15		130	43	513	320		6.0	14.0		
03/26/15		210	52	736	570		1.2	1.7		
<b>PER060</b>										
07/09/13	200	150	50	587	120	ND	0.8	1.9	120	8300
09/04/13									280	12000
12/09/13	240	180	59	696	420	ND	0.5	1.2	130	8300
02/10/14	220	180	58	698	420	0.0004	1.1	ND		
03/20/14	380	100	67	528	480	0.0003	1.7	1.0	150	9200
04/01/14	180	160	45	587	460	0.0011	1.7	2.1		
07/17/14									480	9900
09/11/14		160	51	605	330		1.1	1.4	140	8300
12/10/14		200	58	727	390		2.3	1.4	150	14000
01/19/15		190	60	714	460		1.6	ND		
02/09/15		150	47	574	360		4.3	14.0		
03/26/15		190	50	680	550		1.2	1.4	120	7300
<b>PER045</b>										
07/09/13									20	4200
09/04/13									61	8100
12/09/13									21	5900
03/20/14									180	29000
07/17/14									42	8700
09/11/14									48	6500
12/10/14									37	28000
02/09/15		110	41	442	220		6.5	27.0		
03/26/15		170	49	638	460		1.6	ND	100	14000
<b>PER035</b>										
07/09/13									58	28000
09/04/13									91	11000
12/09/13									19	41000

Station/ Date	Total Alkalinity as CaCO3 (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Hardness, Total as CaCO3 (mg/L)	Sulfate as SO4 (mg/L)	Chlorophyll-a (mg/L)	Total Organic Carbon (mg/L)	Total Suspended Solids (mg/L)	Sediment Sulfate as SO4 (mg/kg)	Sediment Total Organic Carbon (mg/kg)
03/20/14									17	49000
07/17/14									16	17000
09/11/14									49	43000
12/10/14									17	47000
03/26/15									17	42000
<b>PER010</b>										
07/09/13	300	80	58	440	150	0.0120	3.4	1.5	110	9900
09/04/13	260	64	48	359	130	0.1200	4.9	4.0	120	20000
11/04/13	310	98	55	471	120	0.0300	3.3	18.0		
12/09/13	390	120	61	554	130	0.0033	2.8	27.0		
01/15/14	380	120	65	556	120	0.0048	1.5	7.2	120	10000
02/10/14	360	120	70	589	180	0.0069	6.7	13.0		
03/20/14	200	170	48	614	160	0.0190	3.0	5.2	89	8700
04/01/14	180	48	28	234	99	0.0010	8.4	3.6		
07/17/14		77	48	389	110		5.2	7.1	48	4500
09/11/14		250	680	3440	1500		3.8	76.0	180	11000
11/12/14		130	66	595	170		2.4	15.0		
12/10/14		140	76	663	190		3.9	74.0	150	8000
01/19/15		120	86	656	210		4.3	17.0		
02/09/15		77	54	414	140		14.5	10.0		
03/26/15		120	75	608	200		4.7	4.9	90	9500
<b>STE020</b>										
07/09/13	380	100	39	415	100	ND	1.1	1.6	73	7800
09/04/13	320	92	39	390	100	ND	1.4	3.6	540	25000
12/09/13	360	130	47	514	120	0.0004	0.7	0.6	40	4800
03/20/14	340	110	40	438	110	0.0069	1.3	4.4	310	6400
07/17/14		120	42	484	110		1.4	4.5	110	11000
09/11/14		110	40	449	110		1.3	6.5	86	2700
12/10/14		150	59	616	160		1.5	ND	52	2700
02/09/15		88	32	352	140		6.8	7.0		



Station/ Date	Total Alkalinity as CaCO <sub>3</sub> (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Hardness, Total as CaCO <sub>3</sub> (mg/L)	Sulfate as SO <sub>4</sub> (mg/L)	Chlorophyll-a (mg/L)	Total Organic Carbon (mg/L)	Total Suspended Solids (mg/L)	Sediment Sulfate as SO <sub>4</sub> (mg/kg)	Sediment Total Organic Carbon (mg/kg)
03/26/15		120	44	486	130		1.5	1.5	43	4600
<b>STE010</b>										
07/09/13	360	130	87	680	160	0.0150	2.1	540.0	1400	9300
09/04/13	360	110	50	489	120	0.0190	3.2	2800.0	2300	20000
12/09/13	360	120	53	524	140	0.0130	1.6	1100.0	540	23000
03/20/14	280	210	420	2240	830	0.0400	3.1	51.0	1500	18000
07/17/14		140	83	693	210		3.5	1800.0	2200	13000
09/11/14		340	1100	5200	2700		3.6	210.0	2800	37000
12/10/14		160	190	1190	360		2.4	45.0	1600	17000
02/09/15		80	32	333	120		7.0	27.0		
03/26/15		120	49	492	130		2.2	400.0	1700	17000